Technical Note

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Use of Juniper Trees to Stabilize Eroding Streambanks on the South Fork John Day River

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Introduction

Streambank stabilization may be required for the improvement of water quality, fish habitat, and the maintenance of productive riparian areas. Rock revetment, gabions and other structures are often used for bank stabilization. Placement of cut juniper trees anchored to banks proved beneficial for bank stabilization on the South Fork of the John Day River in north-eastern Oregon (Figure 1).

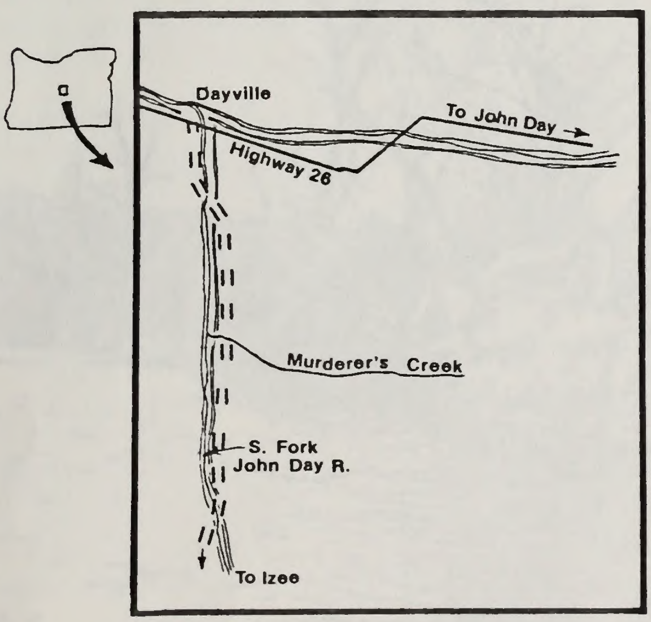

Figure 1 Location map

Background

The South Fork of the John Day River and its tributaries provide habitat for an annual run of approximately 2,000 spawning steelhead and a population of resident rainbow trout.

The South Fork drains 590 sq. miles of forest and rangeland in the Blue Mountains. The average annual peak flow is approximately 1,000 cfs., and the low flow is about 15 cfs. The elevation ranges from 2,345 feet to 6,991 feet above sea level. Most of the higher country is covered with timber, although brushland, juniper, and grassland are found at lower elevations.

Water quality and fisheries problems in the South Fork drainage are primarily associated with heavy grazing along the riparian zone, a road density often exceeding 4 mi./sq.m., and logging. In addition, streams on private property in the headwaters of the South Fork have been channelized and willows removed from their banks.

A coordinated resource management plan between BLM-USFS-ODF&W covering 142,000 acres of the South Fork drainage was developed in 1973. A streambank erosion survey, conducted in 1975, identified 2,264 linear yards of severe bank erosion on 12 miles of the South Fork.

Methods used to stabilize eroding banks utilizing rock riprap are often costly. Due to high costs of treating extensive erosion problem areas, a technique was needed that would accomplish bank stabilization with minimal costs and equipment. Juniper tree revetment had been used on a limited scale by some private landowners in the John Day area with variable success. Since juniper is abundant along the South Fork, we decided to use juniper revetment on many problem areas. Junipers were placed on 2,150 linear yards of eroded bank between 1974 and 1979.

Description

Tree size desirable for placement depends on the availability of equipment. Youth Conservation Corps crews used to place trees had difficulty handling trees over 6 inches dbh by hand. Tractors made the handling of larger trees possible (Figures 2 and 3). Trees with a bushy or heavy crown are preferred over slender ones. Green trees should be used. Trees were placed about one tree per yard of bank. A 2 to 3 ton, tilt-bed truck with solid sideboards was most practical for hauling trees.

Trees should be angled downstream (Figure 4). Tree butts were tied with #9 smooth wire and attached to an anchor point. Fence posts and "dead manned" cable were used as anchors. Fence posts were driven to within 4 inches of the ground and wires tied tight. Fence posts should be at least 5 feet back from the bank. When cable is used, the cable should lie flat on the ground to reduce the tripping of large grazing animals and humans. Scrap power line wire (4 CSR wire) was donated by a local electric cooperative and used extensively in place of cable.

YCC crews worked for two weeks each summer from 1976 to 1978. Four hundred fifty work days were needed to treat 1,500 yards of eroded bank. YCC travel time, environmental education, etc., probably reduced actual work time by at least 20%. The

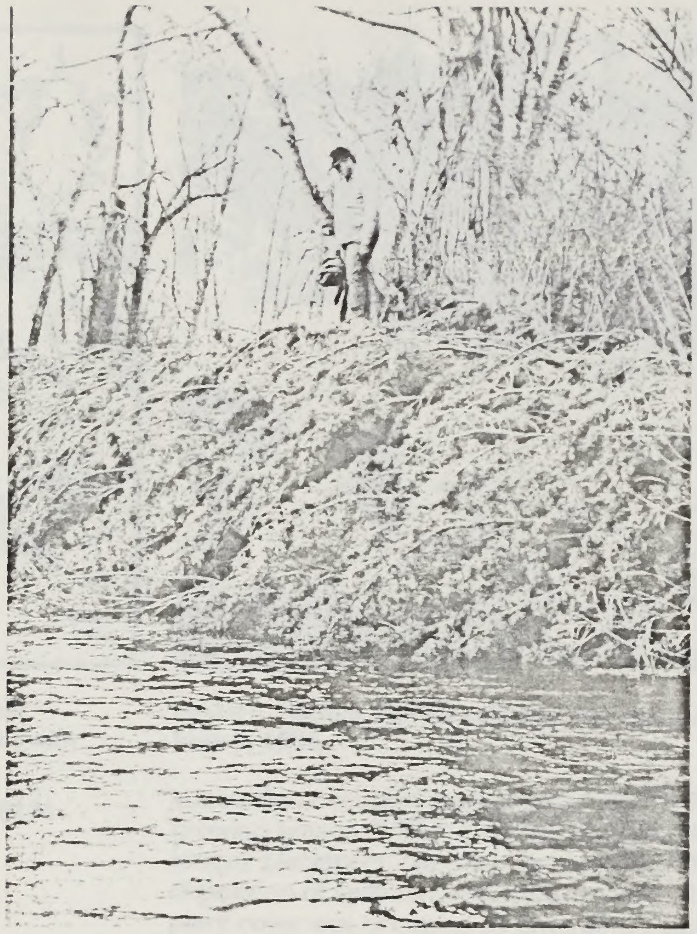

Figure 3 Completed work.

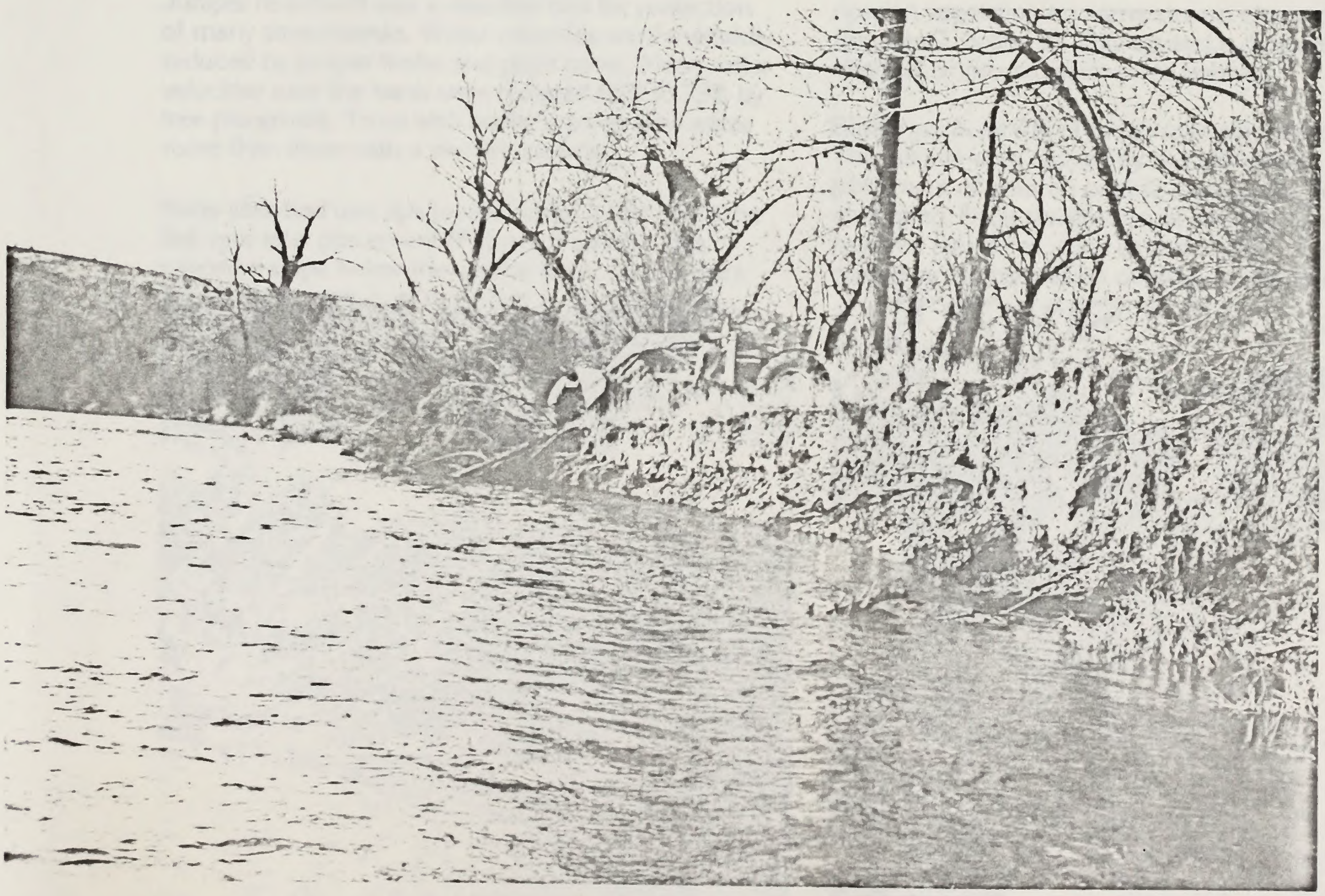

Figure 2 Tractor used in placing junipers on eroding bank.

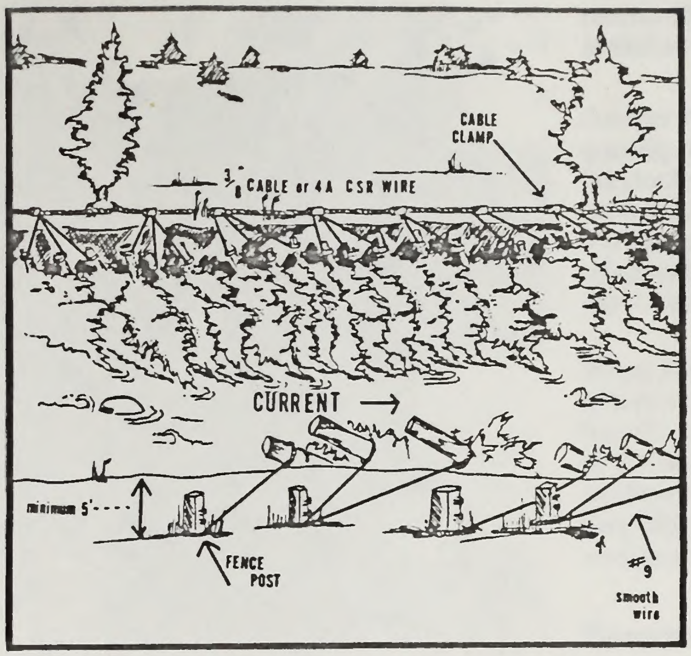

Figure 4 Juniper Placement Methods. Fence post anchors were 5½′ posts cut in two pieces. The end with the soil plate was 24″ long.

remaining area treated was by ODF&W and BLM crews between 1974 and 1979.

Evaluation

Juniper revetment was a valuable tool for protection of many streambanks. Water velocities were markedly reduced by juniper limbs and plant cover. Mean water velocities near the bank were reduced 66% to 73% by tree placement. Trees with bushy crowns slow water more than those with a slender crowns.

Many sites had tree tips buried under 2 feet of silt the first year after placement (Figures 5 and 6). This formed a slope below the vertical bank. Native plant

Figure 6 After. Junipers were placed on the bare, eroded bank during the summer of 1977. This photo was taken during the fall of 1978. Banks have sloped due to silt deposition and the establishment of riparian vegetation.

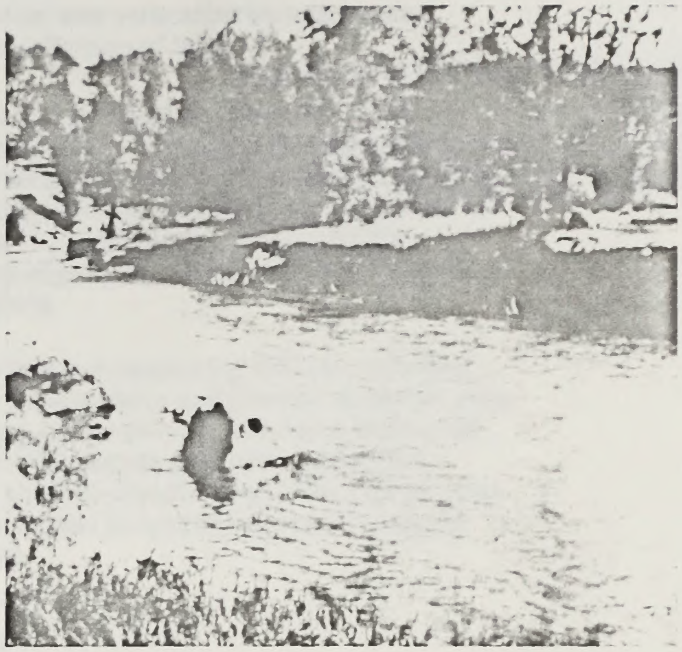

Figure 5 Before. Vertical cutbanks were present on far bank in 1976.

succession occupied such sites during the first growing season. Willow cuttings, planted prior to juniper placement, often were successful. The annual deposition of sediment collected in tree limbs and plant cover was occupied by emerging native plants by early summer. Proper grazing management plus bank stabilization allowed an encroachment of riparian vegetation on some stream channels (Figures 7, 8, and 9). This caused a deepening of the channel, improving salmonoid habitat.

Eighty yards, or 4%, of the juniper placement failed. The failures were caused by two situations; placement of trees on outside curves and poor anchoring. Bank stabilization of outside curves required structures, such as rock riprap. Junipers placed by themselves on outside curves failed

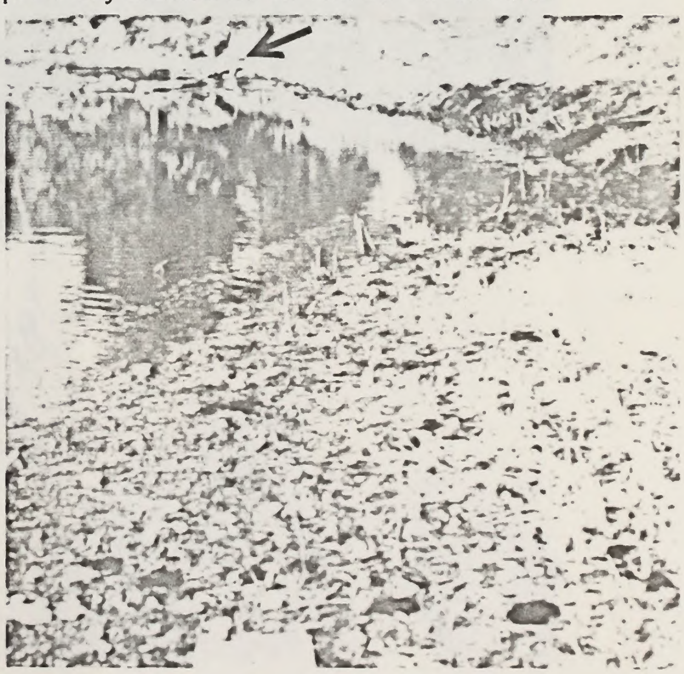

Figure 7 This area was devoid of riparian vegetation in 1973. Cutbank occurred behind the cow (see arrow).

Figure 5. Juniper revetment ... with ... 1976.

[illegible] during the first growing season. Willow cuttings [illegible] planted [illegible]. The survival [illegible] was estimated [illegible] (Figures 7 & [illegible]). This caused a [illegible].

[illegible]. The junipers [illegible].

Figure 4. Juniper Placement Methods. Planting trenches were 3-5" deep and 8' in diameter. The area along the soil plain was 265' long.

[illegible] between 1976 and 1978.

Evaluation

Juniper treatment was a valuable tool for protection of many stream banks. Water velocities were markedly reduced by juniper limbs and plant cover. Water velocities near the bank were reduced 66% to 75% by tree placement. Trees with bushy crowns slowed water more than those with a slender canopy.

Many sites had sediment deposits about 2 feet in depth the first year after placement (Figures 5 and 6). This formed a slope before the natural bank. Native plants and [illegible]

Figure 7. This site was [illegible] 1976. Cattails [illegible] the [illegible].

Figure 6. After junipers were placed [illegible] bank during the summer of 1975. This photo was taken during the fall of 1976. [illegible] due to silt deposition and the establishment of riparian vegetation.

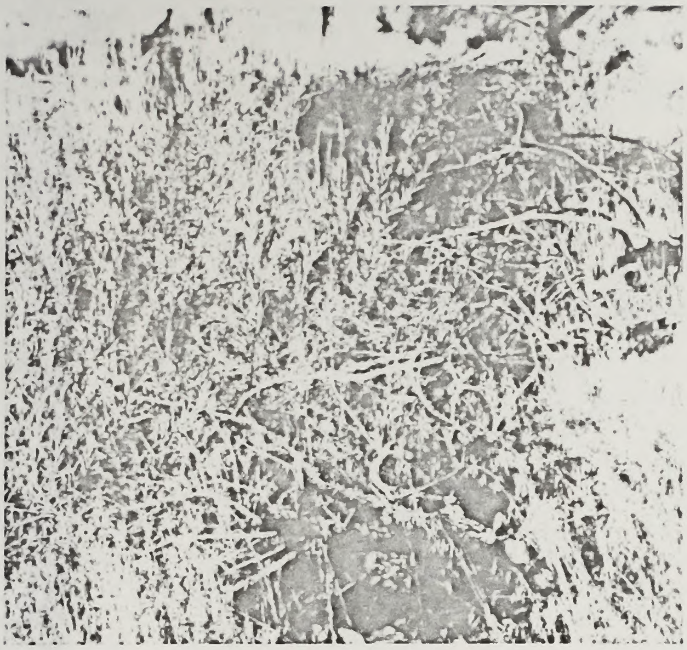

Figure 8 Closeup of cutbank shown in figure 7. Willows and herbaceous vegetation are established.

because water cut behind trees causing bank erosion. However, junipers used in combination with rock deflectors were beneficial. Fence post anchors driven too close to streambanks caused banks to slough off and trees to detach. When trees were not tightly tied to cables, water cut behind them causing bank erosion. This could also occur on streams having a narrow channel with vertical banks and no area available for deflection of flows.

Juniper revetment should be used with proper grazing management. Although tree limbs impair livestock grazing, domestic animals attempt to graze on the succulent forage and break off some twigs in the process. Heavy livestock use reduced the effectiveness of junipers, which caused additional bank sloughing.

When sampling was conducted with electrofishing equipment, rainbow trout and juvenile steelhead were found using junipers as cover when tree limbs were in the water. Also aquatic and terrestrial insects, furbearers, small mammals, song birds, reptiles, and amphibians utilized juniper revetment for foraging and as cover.

Summary

Cut juniper trees anchored along eroded banks proved beneficial in stabilizing them, often during the first year. Our work shows that juniper revetment is a successful substitute for costly rock structures on straight or slightly curved banks. Failure occurred on only 4% of the banks treated between 1974 and 1979. Failures were associated with improper anchoring and placement of trees on outside curves.

Figure 9 Photo taken during the summer of 1978. The same site as figure 7. This site was lightly grazed annually during the fall. Junipers were placed on the cutbank in 1977. Note encroachment of willows on left bank point bar (arrow). Point bar was bare of willows in figure 7.

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